

# City of Fennimore

*"The city on the move!"*



City Clerk-Treasurer  
Zoning Administrator  
(608) 822-6119

Director of Public Works/  
City Engineer  
(608) 822-6501

Fennimore Utilities  
Business Office  
(608) 822-6110

January 26, 2001

Jim Loock, Chief Electric Engineer  
Public Service Commission  
610 N. Whitney Way  
P.O. Box 7854  
Madison, WI 53707-7854

RE: In the Matter of Filing Plans for Appropriate Inspection and  
Maintenance, PSC Rule 113.0607.

Dear Mr. Loock:

Enclosed for filing are 3 copies of Fennimore Municipal Utilities's Preventative Maintenance Plan detailing inspection maintenance schedules, condition rating criteria, corrective action schedules, record keeping procedures and report filing schedules as documented in this rule.

Very truly yours,

Gregory J. Lee  
Director of Public Works  
City of Fennimore

Enclosures

**RECEIVED**

JAN 30 2001

Electric Division

# **PREVENTATIVE MAINTENANCE PLAN**

## **FENNIMORE MUNICIPAL UTILITIES**

**FILING DEADLINE**

**FEBRUARY 1, 2001**

January 26, 2001

Gregory J. Lee

860 Lincoln Ave

Fennimore, WI 53809

(608) 822-6501

RECEIVED  
JAN 30 10 30  
ELECTRIC SERVICE

**RECEIVED**

JAN 30 2001

Electric Division

This plan was prepared by the MEUW work group for PSC Rule 113.0607 for use by the 82 municipal electric utilities in Wisconsin and endorsed by PSC staff as meeting the requirements of Rule PSC 113.0607.

## **TABLE OF CONTENTS**

	Page
I. Preventative Maintenance Plan	2
II. Inspection Schedule and Methods	2
III. Condition Rating Criteria	3
IV. Corrective Action Schedule	4
V. Record Keeping	4
VI. Reporting Requirements	4
VII. Distribution – overhead inspection guide	5
VIII. Distribution – underground inspection guide	8
IX. Substation - Monthly inspection guide	10
X. Substation – Annual Inspection Guide	18
XI. Transmission – Annual Inspection Guide	20
XII. Transmission – 5 Year Inspection Guide	21

## **FORMS**

OVERHEAD DISTRIBUTION INSPECTION FORM	7
UNDERGROUND DISTRIBUTION INSPECTION FORM	9
MONTHLY SUBSTATION INSPECTION FORM	13 – 17
ANNUAL SUBSTATION INSPECTION FORM	19
ANNUAL TRANSMISSION INSPECTION FORM	22

## **I. Preventative Maintenance Plan**

The PSC 113.0607 rule reads;

Appropriate inspection and maintenance: system reliability.

(1) PREVENTATIVE MAINTENANCE PLAN. Each utility or other person subject to this chapter, including persons who own electric generating facilities in this state who provide service to utilities with contracts of five years or more, shall develop and have in place its own preventative maintenance plan. This section is applicable to electric generating facilities as set forth at s. 194.491(5)(a)(1), Stats. Each plan shall include, among other things, appropriate inspection, maintenance and replacement cycles where applicable for overhead and underground distribution plant, transmission, generation<sup>1</sup>, and substation facilities.

(2) CONTENTS OF THE PLAN. (a) *Performance standard.* The Preventative Maintenance Plan shall be designed to ensure high quality, safe, and reliable service, considering: cost, geography, weather, applicable codes, national electric industry practices, sound engineering judgment and experience.

1 *PSC staff interpretation is that generation applies to individual generators equal to or greater than 50 MW.*

## **II. Inspection Schedule and Methods:**

The purpose of this plan is to maintain or improve the electrical system reliability with the objective of increased municipal loyalty and satisfaction from our constituents. The goals are to meet and exceed the schedules established in this plan.

Exception reporting (inspected equipment not in good condition) will be the method of documentation on all inspection forms.

The scope of this plan is traditional and uses proven maintenance techniques. Unique operating and maintenance philosophies have not been considered. Also, manufacturer defects will be dealt with as they are communicated to this utility.

SCHEDULE:	MONTHLY	ANNUAL	EVERY 5 YEARS
Transmission ( $\geq 69\text{Kv}$ and above)		<b>X</b>	<b>X</b>
Substations	<b>X</b>	<b>X</b>	
Distribution (OH & UG)			<b>X</b>

The inspection of Distribution facilities will be by individual substation circuits on a 5-year cycle such that the entire system will be inspected every 5 years. Inspector instructions for inspecting all facilities and forms are included with the plan.

**METHODS:** Five criteria groups will be used to complete the inspection of all facilities.

1. IR – infrared thermography used to find poor electrical connections and/or oil flow problems in equipment.
2. RFI - Radio Frequency Interference, a byproduct of loose hardware and connections, is checked using an AM radio receiver.
3. SI – structural integrity of all supporting hardware including poles, crossarms, insulators, structures, bases, foundations, buildings, etc.
4. Clearance – refers to proper spacing of conductors from objects, trees and other utility cables.
5. EC – equipment condition on non-structural components such as circuit breakers, transformers, regulators, reclosers, relays, batteries, capacitors, etc.

### **III. Condition Rating Criteria:**

This criterion, as listed below, establishes the condition of a facility and also determines the repair schedule to correct deficiencies.

- 0) Good condition
- 1) Good condition but aging
- 2) Non-critical maintenance required – normally repair within 12 months
- 3) Priority maintenance required – normally repair within 90 days
- 4) Urgent maintenance required – report immediately to the utility and repair normally within 1 week

### **IV. Corrective Action Schedule**

The rating criteria as listed above determine the corrective action schedule.

### **V. Record Keeping**

All inspection forms and records will be retained for a minimum of 10 years. The inspection form contains all of the required critical information i.e. inspection dates, condition rating, schedule for repair and date of repair completion.

### **VI. Reporting Requirements**

A report and summary of this plan's progress will be submitted every two years with the first report due to the Commission by February 1, 2003. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

## **VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE**

### **STRUCTURE**

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires
- U Guard/Conduit Condition

### **EQUIPMENT**

- Transformers
  - ✓ Oil Leaks
  - ✓ Bushing Condition
  - ✓ Grounding/Bonding
- Capacitors
  - ✓ Fuses Blown
  - ✓ Bushing Condition
  - ✓ Oil Leaks
  - ✓ Tank Bulged
  - ✓ Switches, Oil, Vacuum
  - ✓ Control Conduit/Wiring
  - ✓ Grounding/Bonding
- Switches - GOAB, Inline, Disconnect
  - ✓ Insulator Condition
  - ✓ Operating Handle/Locks
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number
- Cutouts
  - ✓ Insulator Condition
  - ✓ Fuse Size Tag

## **VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE (con't)**

### **EQUIPMENT (CON'T)**

- Arrestor
  - ✓ Insulator Condition
  - ✓ Connections
  - ✓ Ground Lead Disconnection
- Cable Terminators
  - ✓ Insulator Condition
  - ✓ Grounding/Bonding

### **CLEARANCES**

- Ground Line
- Buildings, Bridges, Swimming Pool, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Transmission Lines
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
  - ✓ Clearance From Line
  - ✓ Vines on Poles
  - ✓ Danger Trees

### **INFRARED SCAN**

- Main Three-Phase Feeders
- Priority Overhead Transformer Banks
  - ✓ Bushing Connectors Primary
  - ✓ Bushing Connectors Secondary
  - ✓ General Tank Heating
- Current & Voltage Transformers if Applicable

### **RFI CHECK**

- OH system with AM radio as each circuit is inspected



## Date \_\_\_\_\_ Inspected by \_\_\_\_\_ Sub \_\_\_\_\_ Ckt \_\_\_\_\_

Date \_\_\_\_\_ Inspected by \_\_\_\_\_ Sub \_\_\_\_\_ Ckt \_\_\_\_\_

## Subs

**Ckt**

[illegible]

## **VIII DISTRIBUTION – UNDERGROUND INSPECTION GUIDE**

### **STRUCTURAL (Exterior & Interior) Transformer, Primary Pedestal, Secondary Pedestal, Switchgear.**

- Enclosure Condition
- Level/Leaning
- Security
- Grade/Accessibility (Shrubs, Customer Facilities, Fill/Excavation)
- Numbering
- Voids/Gaps
- Signage - Location Number, Warning Sign
- Pad/Vault Condition

### **EQUIPMENT**

- Transformers
  - ✓ Oil Leaks
  - ✓ Bushing Condition
  - ✓ Grounding/Bonding
  - ✓ Elbows
  - ✓ Arrestors
  - ✓ Feed-Through
  - ✓ Cable Condition
  - ✓ Secondary Connections
- Primary Pedestals
  - ✓ Elbows
  - ✓ Junction Condition
  - ✓ Grounding/Bonding
- Secondary Pedestals
  - ✓ Secondary Connections
- Switches – URD Switchgear
  - ✓ Insulator Condition
  - ✓ Operating Handle Security
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number/Fuse Size & Number

### **INFRARED SCAN and RFI CHECK**

- Main Three-Phase Feeders (Risers & Switchgear)
- Priority URD Transformer Banks
  - ✓ Bushing Connectors Primary
  - ✓ Bushing Connectors Secondary
  - ✓ General Tank Heating



## **IX SUBSTATION - MONTHLY INSPECTION GUIDE**

### **TRANSFORMER MAIN TANK:**

- Oil in bushings
- Bushing and arrestor porcelain
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Oil leaks
  - ✓ Main tank
  - ✓ Sample valves
  - ✓ Radiators
- Radiator bank
  - ✓ warm on top, cool at bottom
- Tank pressure
- Tank oil level
- Temperature gauge
- Cooling fans

### **TRANSFORMER LTC or VOLTAGE REGULATORS:**

- Tank oil level
- Drag hand positions
- Cabinet light
- Operation count
- Tank pressure
- Cabinet heater
- Cabinet contamination

### **TRANSMISSION CIRCUIT BREAKERS:**

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Line and load side disconnect switches
  - ✓ Properly labeled
  - ✓ Aligned properly
- Handles grounded
- Emergency trip button
- Air / Oil compressors
- Air / Oil pressure gauge
- Spring operated mechanism
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

## **IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)**

### **FEEDER CIRCUIT BREAKERS / RECLOSERS**

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Line and load side disconnect switches
  - ✓ Labeled properly
  - ✓ Aligned properly
  - ✓ Handles grounded
- Emergency trip button
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

### **HIGH AND LOW VOLTAGE BUSS WORK:**

- Bushing, insulator, arrestor, and support insulators
  - ✓ Chips or cracks
  - ✓ Rust or dirt
- Bird nests
- Potential transformers bushings
  - ✓ Cracks or chips
  - ✓ Rust or dirt
- Cable terminators
  - ✓ Leaking fluid
  - ✓ Cracks or chips

### **MANUAL SWITCHES:**

- Properly labeled
- Ground connections
- Positioning and alignment
- Bushing and support insulators
  - ✓ Cracks or chips
  - ✓ Rust or dirt

### **MOTOR OPERATED SWITCHES:**

- OPEN/CLOSED indicator
- Properly labeled
- Cabinet heater
- Operations counter

## **IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)**

### **CONTROL HOUSE/MISCELLANEOUS:**

- Clock displays proper time
- AC/DC load center breakers
- Room temperature
- Rodents
- Panels labeled properly
- Panel lights
- Annunciator panel
- Panel meters
- SCADA system RTU
- SCADA alarms
- Position indicators agree
- Relay target information
- Emergency contact directory & dial tone for phone
- Safety Equipment

### **BATTERY:**

- Liquid levels
- Proper float voltage on charger and battery
- Specific gravity in pilot cell
- Personal Protective Equipment
- Connection corrosion
- Leaking cells
- Dated solution in eyewash station

### **YARD AND FENCE:**

- Fire extinguisher charged
- Fence ground connections
- Fence secured
- Security and emergency lights
- Site base and grade
- Standing water
- Warning signs

# MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

SUBSTATION: \_\_\_\_\_

## TRANSFORMER MAIN TANK

RATING: 0    1    2    3    4    (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Oil in Bushings				
Bushing and Arrestor				
Oil Leaks				
Main Tank				
Sample Valves				
Radiators				
Radiator Bank				
Tank Pressure				
Tank Oil Level				
Temperature Gauge				
Cooling Fans				

## TRANSFORMER LTC or VOLTAGE REGULATORS

RATING: 0    1    2    3    4    (Circle One)

Tank Oil Level				
Drag Hand Positions				
Cabinet Light				
Operation Count				
Tank Pressure				
Cabinet Heater				
Cabinet Contamination				

## MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

**HIGH VOLTAGE CIRCUIT BREAKER /  
CIRCUIT SWITCHER**

RATING: 0    1    2    3    4    (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
OPEN/CLOSED Indicator				
CHARGED/DISCHARGED Indicator				
Cabinet Light				
Cabinet Heater				
Operations Counter				
Bushings and Supports				
Line and Load Side Disconnect Switches				
Handles Grounded				
Emergency Trip Button				
Air Compressors - Air / Oil				
Air Pressure Gauge - Air / Oil				
Spring Operated Mechanism				
Oil Level Gauge				
Tank Oil Leaks				
Reset Switch				
Cabinet Contamination				
Vents Clean				
Gas Pressures for GCBs				



# MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

## FEEDER CIRCUIT BREAKER / RECLOSER

**RATING: 0 1 2 3 4 (Circle One)**

[illegible]

# MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

SUBSTATION: \_\_\_\_\_

## HIGH & LOW VOLTAGE BUSS WORK

RATING: 0 1 2 3 4 (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Bushing, Insulator, Arrestor, and Supports				
Bird Nests				
Transformer Bushings				
Cable Terminators				

## MANUAL SWITCHES

RATING: 0 1 2 3 4 (Circle One)

Properly Labeled				
Ground Connections				
Positioning and Alignment				
Bushings and Supports				

## MOTOR OPERATED SWITCHES

RATING: 0 1 2 3 4 (Circle One)

OPEN/CLOSED Indicator				
Proper Labeling				
Cabinet Heater				
Operations Counter				
locking criteria				

# MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

SUBSTATION: \_\_\_\_\_

## CONTROL HOUSE/MISCELLANEOUS

RATING: 0 1 2 3 4 (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Clock Displays Proper Time				
AC/DC Load Center Breakers				
Room Temperature				
Rodents				
Panels Labeled Properly				
Panel Lights				
Annunciator Panel				
Panel Meters				
SCADA System RTU				
SCADA Alarms				
Position Indicators Agree				
Relay Target Information				
Emergency Contact Directory & Dialtone for Phone				
Safety Equipment				

## BATTERY

RATING: 0 1 2 3 4 (Circle One)

Liquid Levels				
Proper Float Voltage on Charger & Battery				
Specific Gravity in Pilot Cell				
Personal Protective Equipment				
Connection Corrosion				
Leaking Cells				
Dated Solution in Eyewash Station				

## YARD & FENCE

RATING: 0 1 2 3 4 (Circle One)

Fire Extinguisher Charged				
Fence Ground Connections				
Fence Secured				
Security and Emergency Lights				
Site Base and Grade				
Standing Water				
Warning Signs				

## **X Substation - Annual Inspection Guide**

- Check equipment for level
- Check condition of concrete pads
- Perform oil and DGA analysis
- Battery
  - ✓ Intercell strap resistance
  - ✓ Individual cell voltages
  - ✓ Cell specific gravity
- Nameplate legible
- Equipment paint condition
- Proper equipment ID labels
- IR / RFI scans and checks

# ANNUAL SUBSTATION INSPECTION FORM

Date \_\_\_\_\_ Inspected by \_\_\_\_\_ Substation \_\_\_\_\_

EQUIPMENT LISTING	SUBSTATION INSPECTION CRITERIA								COMMENTS	MAINTENANCE COMPLETED	
	Check equipment for level	Check condition of concrete pads	Perform oil and DGA analysis	Battery checks - Intercell strap resistance, individual cell voltages, Cell specific gravity	Nameplate legible	Equipment paint condition	Proper identification labels	IR / RFI scans and checks		Date Item Corrected	Corrected By
Transformer											
LTC or regulators											
High Voltage Breaker											
Feeder CBs / Reclosers											
Switches											
Control house battery											
Transmission line RFI											

## **XI TRANSMISSION – ANNUAL INSPECTION GUIDE**

### **STRUCTURE**

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires

### **EQUIPMENT**

- Switches - GOAB, Disconnect
  - ✓ Insulator Condition
  - ✓ Operating Handle/Locks
  - ✓ Linkage
  - ✓ Grounding/Bonding
  - ✓ Switch Number
- Arrestor
  - ✓ Insulator Condition
  - ✓ Connections

### **CLEARANCES**

- Ground Line
- Buildings, Bridges, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
  - ✓ Clearance From Line
  - ✓ Vines on Poles
  - ✓ Danger Trees

## **XI TRANSMISSION – ANNUAL INSPECTION GUIDE (con't)**

### **RFI CHECK**

- Splices
- Connectors
- Dead Ends
- Switches
- Structures

## **XII TRANSMISSION – 5 YEAR INSPECTION GUIDE**

### **IR SCAN**

- Splices
- Connectors
- Dead Ends
- Switches

## Date \_\_\_\_\_ Inspected by \_\_\_\_\_ Sub \_\_\_\_\_ Ckt \_\_\_\_\_

22